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THE CANADIAN NOSOCOMIAL INFECTION SURVEILLANCE PROGRAM: RESULTS OF THE FIRST 18 MONTHS OF SURVEILLANCE FOR METHICILLIN-RESISTANT *STAPHYLOCOCCUS AUREUS* IN CANADIAN HOSPITALS	F-1	41 – 45
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THE CANADIAN NOSOCOMIAL INFECTION SURVEILLANCE PROGRAM: RESULTS OF THE FIRST 18 MONTHS OF SURVEILLANCE FOR METHICILLIN-RESISTANT *STAPHYLOCOCCUS AUREUS* IN CANADIAN HOSPITALS

Introduction

The emergence of organisms resistant to multiple antimicrobial agents is occurring worldwide. Among these organisms, methicillin-resistant *Staphylococcus aureus* (MRSA) has been found to have a major impact on patient care and has been responsible for numerous outbreaks in hospitals. The prevalence of MRSA increased from < 3% in the early 1980s to rates as high as 40% in many hospitals in the United States and Europe[1-4]. The first outbreak due to MRSA in Canada was reported in 1981[5]. Since then, MRSA has been identified in many Canadian hospitals and long-term care facilities[6-10]. Community-acquired MRSA has also been described in Aboriginal communities in the Prairie provinces[11, 12]. However, nationwide data describing the incidence and epidemiology of MRSA infection in Canada were not available prior to 1995. This report presents preliminary results of the first national MRSA surveillance study, conducted as part of the Canadian Nosocomial Infection Surveillance Program (CNISP).

Background

CNISP is a collaborative effort involving hospitals across the country, participating as members of the Canadian Hospital Epidemiology Committee (CHEC), a subcommittee of the Canadian Infectious Diseases Society, and the Laboratory Centre for Disease Control (LCDC), Health Canada. The objectives of CNISP are 1) to determine national nosocomial infection rates, 2) to determine the impact of infection due to multiresistant organisms, and 3) to provide evidence-based data that may be used in the development of national guidelines for the prevention of nosocomial infections. CNISP surveillance for MRSA started in January 1995 and is ongoing. This report summarizes the results of the first 18 months of surveillance, to July 1996.

Methods

A total of 21 hospitals, in nine provinces, participated in the surveillance. Nineteen are tertiary-care teaching hospitals, representing approximately three-quarters of the university-affiliated teaching centres in the country. Ten are associated with long-term care facilities. Five are pediatric hospitals.

Surveillance was hospital laboratory-based. When MRSA was identified, the hospital's infection-control practitioner reviewed the patient's chart for demographic and clinical information. Isolates were sent to LCDC to confirm identification and antimicrobial susceptibility. Isolates were typed by pulsed-field gel electrophoresis (PFGE) following DNA extraction and digestion with *Sma*I. Categoric data were analyzed using the chi-square test or Fisher's exact test; Student's *t*-test was used for normally distributed continuous variables.

Results

In the first 18 months of surveillance, 440 cases of MRSA were reported from 20 of the 21 participating hospitals (range: 0 to 87 MRSA cases/hospital) (Table 1). This represented a mean of 1.6 MRSA cases per 100 *S. aureus* isolates during 1995 and the first half of 1996, and a mean of 0.6 MRSA cases per 1,000 patient-admissions. There was an increase from 209 cases (1.2% of *S. aureus* isolates) identified in 1995 to 231 cases (2.3% of *S. aureus* isolates) reported up to July 1996 ($p < 0.001$). Whereas only 39% of the MRSA cases were from Ontario and Quebec in 1995, 70% were from participating hospitals in these two provinces in the first half of 1996 (Table 2).

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Table 1
MRSA cases in Canadian hospitals, January 1995 — July 1996

MRSA	1995	1996 (up to July)
No. of cases	209	231
Mean no. of MRSA cases per 100 *S. aureus* isolates	1.2	2.3
Mean no. of MRSA cases per 1,000 admissions	0.5	0.9

Table 2
Geographic distribution of MRSA cases in Canadian hospitals, January 1995 — July 1996

Location	1995 %	1996 (up to July) %
Western Canada	56	19
Ontario, Quebec	39	70
Eastern Canada	5	11

Overall, 57% of the MRSA cases were male, 43% female. Fifty-two percent of the cases were ≥ 65 years old, and only 13% were < 20 years old. Forty-two (10%) cases reporting ethnicity were Aboriginal; most (63%) of these resided on First Nations reserves in Manitoba and Alberta. For the 320 cases where the source of MRSA could be determined, 81% were thought to have been acquired in a hospital, 8% in a long-term care facility, and 11% in the community. Cases in the provinces of Manitoba, Saskatchewan, Alberta, and British Columbia were 1.6 times more likely to have been acquired in a community than were cases from elsewhere in the country ($p = 0.05$).

Most cases were on surgical (30%) or medical (27%) units at the time MRSA was cultured; 10% were in an intensive-care unit. Slightly more than half (52%) of patients had an infection due to MRSA, whereas 48% were colonized. The most common body sites and specimens from which MRSA was isolated were skin and soft tissue (37%), anterior nares (27%), sputum or other respiratory specimens (15%), urine (7%), and blood (3%). The majority of MRSA cultures were obtained as a result of a clinical indication (i.e. an infection was suspected) (Table 3). However, in 1996, the number of cultures obtained as part of an outbreak investigation significantly increased as compared to 1995 ($p < 0.001$). The number of cases thought to be epidemiologically linked to another MRSA case in the same hospital increased from 34% to 56% between 1995 and the first half of 1996 ($p < 0.001$) (Figure 1).

Antimicrobial-susceptibility testing indicated resistance to erythromycin (88% of isolates), clindamycin (62%), ciprofloxacin (76%), trimethoprim-sulfamethoxazole (40%), and rifampin (3%); no vancomycin-resistant isolates were identified.

A total of 288 MRSA isolates from 16 sites have been typed by PFGE. There were 52 distinct genotypes, of which 15 could be further subtyped. Most (70%) isolates could be grouped into one of six DNA profiles. Isolates with similar DNA profiles within a facility were often associated with a recognized epidemiologic link or outbreak. There were 11 DNA profiles; each was present in several hospitals across the country.

Figure 1
Epidemiologic link of a MRSA case to another MRSA case in the same hospital

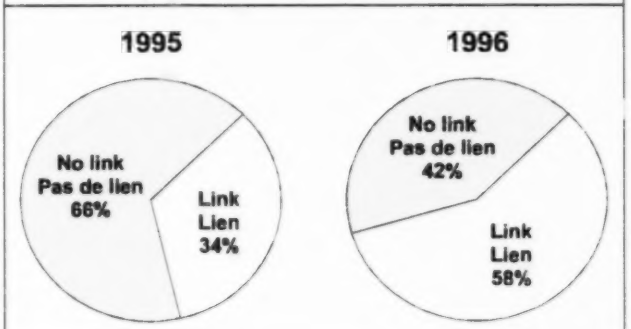

Table 3
Indications for MRSA cultures in Canadian hospitals, January 1995 — July 1996

Reason for culture	1995 %	1996 (up to July) %
Clinical indication	70	55
Outbreak investigation	8	29
Screening	11	16
Previous known carrier	6	0
Unknown	5	0

Discussion

The epidemiology of MRSA in Canadian hospitals has been different from that described in the United States and many other countries for most of the past 15 years. In the United States, for example, MRSA appeared to have spread rapidly and become endemic in many hospitals throughout the 1980s, with prevalence rates as high as 10% to 40% of all *S. aureus* isolates[1-4]. In contrast, MRSA was not thought to be endemic in any Canadian community or health-care facility. There have been relatively few reports in Canada of institutional outbreaks of MRSA and these appeared to have been controlled by implementing stringent infection-control measures[5-10].

The results of the first 18 months of CNISP surveillance confirm that isolation rates of MRSA remain substantially lower in Canadian centres compared to those that have been reported in the United States. However, the occurrence of MRSA is variable in health-care facilities in different parts of the country. As noted recently, there has been a marked increase in MRSA isolation rates in Ontario in the past 1 to 2 years[13, 14]; this increase has been largely attributed to the spread of a single clone of MRSA that has caused outbreaks in many Ontario centres. Elsewhere in the country, MRSA isolation rates appear to remain stable and low at < 2%. Most MRSA cases appear to be hospital-acquired, but a significant number of MRSA cases in Manitoba, Saskatchewan, and Alberta are community-acquired and associated with First

Nations individuals living on reserves, as previously described[9, 12]. Although molecular typing of isolates by PFGE has indicated considerable genetic diversity, there has also been evidence of both intra- and inter-institutional spread of MRSA strains in Canada.

The results of this study may be limited due to the relatively small number of hospitals which participated in the surveillance. However, most of these hospitals are large, urban, tertiary-care centres. Whether these hospitals represent sites in Canada where MRSA is more likely to be found is unknown, but large tertiary-care hospitals in the United States have historically been associated with the highest rates of MRSA[1, 3]. These results do provide an accurate "snapshot" of MRSA in tertiary-care hospitals across the country, and have relevance for other institutions because of the ease with which MRSA is transmitted between health-care facilities, including those which are smaller and community-based[1, 2].

Although challenging and costly, control of MRSA within hospitals has been feasible and considered to be cost-effective, provided aggressive control measures are implemented rapidly[15]. Successful control of antimicrobial resistance also requires a good understanding of the extent and epidemiology of the problem. Continued surveillance is essential as the situation with MRSA and other antibiotic-resistant bacteria, such as vancomycin-resistant enterococci, is constantly evolving.

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METHICILLIN-RESISTANT *STAPHYLOCOCCUS AUREUS* IN ONTARIO

Although several hospital outbreaks of methicillin-resistant *Staphylococcus aureus* (MRSA) have been reported since it was first identified in Ontario in 1979, MRSA was uncommon in Ontario hospitals as late as 1992[1]. As the above report indicates, MRSA incidence is increasing. From 1994 to 1995, the mean isolation rate of MRSA in Ontario increased from 0.4 to 1.0 isolates per 1000 hospital admissions[2]. The data from participating Canadian Hospital Epidemiology Committee hospitals in Ontario suggest that the 1996 increase in Ontario will be even larger. A majority of this increase appears to be due to the success of a single clone of MRSA which is difficult to identify in the laboratory and has several characteristics which facilitate its spread throughout health-care facilities.

Isolates of this clone are identical by pulsed-field gel electrophoresis. There is some variability in phage types. The strain is resistant to most anti-staphylococcal antibiotics, although a few isolates remain susceptible to trimethoprim-sulfamethoxazole. The colonial morphology of isolates may resemble coagulase-negative staphylococci rather than *S. aureus*, and many isolates also have negative rapid-slide coagulase tests, requiring tube coagulase testing. The tube coagulase test may on occasion require a full 24 hours to become positive.

In metropolitan Toronto/Peel region in south-central Ontario, the number of MRSA isolates annually has increased from 115 in 1992 to 1994, to 185 in 1995, and 591 in 1996. In 1996, 27 of 28 reporting hospitals had at least one MRSA-colonized patient. Seventeen (63%) hospitals reported new nosocomial isolates in November or December. Although not all strains have been typed, at least 270 of the 591 isolates are the "staphyloslide-negative" strain described above.

Despite the existence of previously effective MRSA control programs, many of these hospitals have reported outbreaks due to this strain. Characteristics which may explain its efficient dissemination include an apparent propensity to colonize patients at sites other than the nares (notably urine, wound, and groin/rectum), perceived ease of cross-transmission (in some cases to roommates exposed for < 24 hours), and possibly a higher than expected rate of staff colonization. A number of hospitals have found that, compared to other MRSA strains, control of nosocomial transmission has required intensifying both screening and isolation precautions.

This strain is likely to continue spreading across Ontario and into other provinces, and laboratories and infection control programs should be alert to the risk; laboratory identification may require changes to routine microbiology procedures, and control of transmission may require an increase in the rigour with which surveillance for colonization and infection control precautions are carried out[3].

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Source: *A McGeer, MD, D Low, MD, Department of Microbiology, Mount Sinai and Princess Margaret Hospitals, J Conly, MD, I Campbell, MD, Department of Microbiology, The Toronto Hospital, R Devlin, MD, Department of Microbiology, The Wellesley Hospital, A Simor, MD, Department of Microbiology, Sunnybrook Health Science Centre, and the Toronto Practitioners of Infection Control, Toronto; D Gregson, MD, St. Joseph's Health Centre, London, ON.*

Errata

LABORATORY REPORTS OF HUMAN VIRAL AND SELECTED NON-VIRAL AGENTS IN CANADA — 1994 and 1995, VOL. 23-3, PAGE 21

In Table 4 — The five most frequently laboratory-diagnosed agents in 1995, 1994, and 1993 — for 1993 and the agent CT, the number should read 10,817 not 10 and % of total should read **16** not 817.

RESPIRATORY VIRUS SURVEILLANCE — FluWatch Project, VOL. 23-4, PAGE 29

In Figures 2 and 3, the positions of the graphs should be reversed; the titles remain the same.

RESPIRATORY VIRUS SURVEILLANCE
FluWatch Project

Influenza-like illness (ILI) reported to the FluWatch program for the period 1 October 1996 to 19 February 1997, by sentinel physicians, is shown in the figures below. Figure 1 shows the trend in reported ILI across Canada. Figure 2 shows the standardized rates of ILI for Canada by 2-week periods. Figure 3 shows the crude rate of ILI by age group.

The number of reporting physicians varied week by week during the season; however, the average number of patients seen per physician has remained remarkably steady at about 30. Since the decline in reporting recorded in early January (Figure 2), the weekly reporting rates for ILI have remained steady. Although total laboratory reports of influenza isolates have declined, the number and proportion of influenza B virus reports have increased markedly since the beginning of February. The majority of influenza B virus isolates have been recorded in the Prairie provinces, British Columbia, and Ontario, although isolates are reported from all regions.

These findings reflect the wider scene. Influenza B activity increased in the United States in late January and reports from European surveillance programs (as of February 4) indicate concurrent circulation of influenza A and B viruses in a number of countries. The United Kingdom and Spain report recent renewed influenza activity due to influenza B virus.

Figure 1
ILI across Canada, reported by FluWatch, 1 October 1996 - 19 February 1997

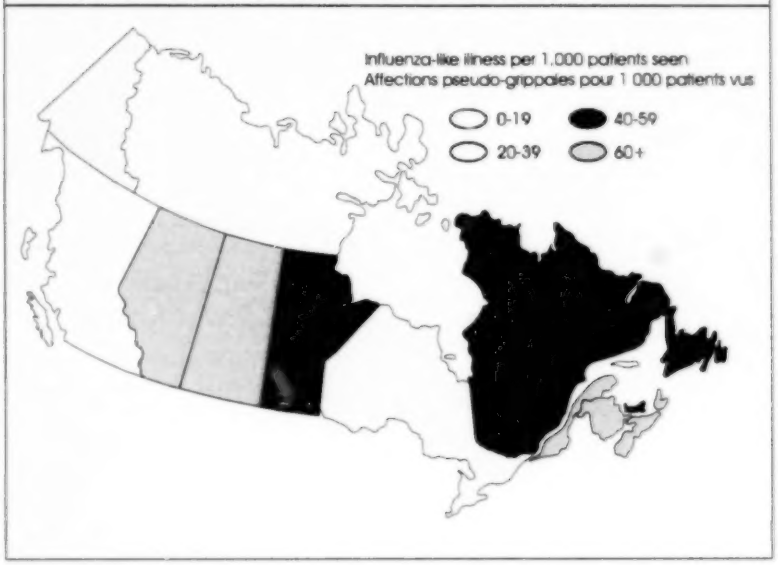


Figure 2
Standardized rates of ILI across Canada by 2-week periods, reported by FluWatch, 19 October 1996 - 12 February 1997 (standardized to Canadian population)

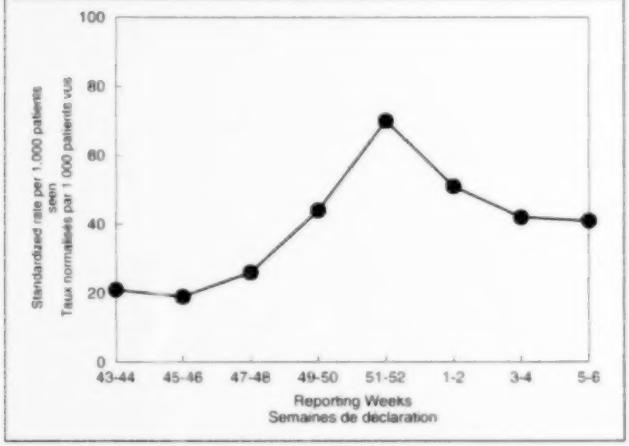
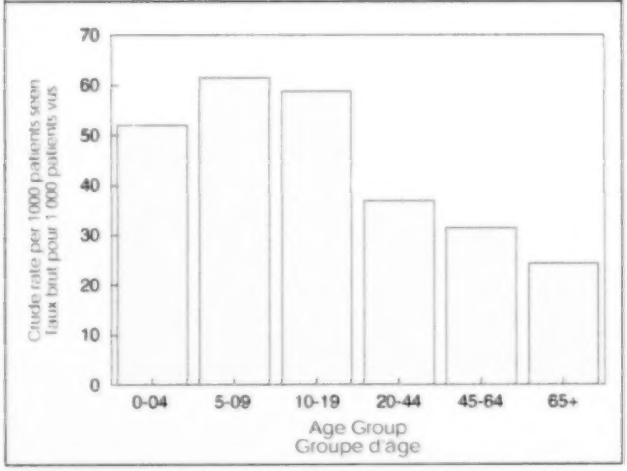


Figure 3
Cumulative rates of ILI across Canada by age group, reported by FluWatch, 1 October 1996 - 19 February 1997



Source: *Division of Disease Surveillance, Bureau of Infectious Diseases, LCDC, Ottawa, ON.*